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# A New Species of *Cyanea* (Campanulaceae: Lobelioideae) from Kaua'i, and the Resurrection of *C. remyi*

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**ABSTRACT.** Two species are added to *Cyanea*, both endemic to Kaua'i. One is new, based on a recently collected specimen. The other was described previously but excluded from the most recent account of the genus due to the inadequacy of the available material. It is reinstated on the basis of data obtained from several newly collected specimens. The genus now includes 56 species and nine heteronymic subspecies.

*Cyanea* Gaudichaud (Campanulaceae: Lobelioideae) is a genus of trees and shrubs endemic to the Hawaiian Islands. Lammers's (1990) treatment of the genus for the *Manual of the Flowering Plants of Hawai'i* included 52 species and nine heteronymic subspecies. Recently, Lammers (1992) added two species from Kaua'i to the genus. In the present paper, *Cyanea* is further enlarged by the addition of two more species from Kaua'i. One is newly described; the other is a previously described species that was not recognized in the *Manual* because of the inadequacy of the available material. As such, *Cyanea* now includes a total of 56 species and nine heteronymic subspecies.

Both of these species were collected at a relatively inaccessible locality known as "The Blue Hole." This site, located east of Kaua'i's center at the headwaters of the Wailua River, is a deep and extremely wet valley head surrounded on three sides by vertical cliffs 900 m high and laced with waterfalls. The vegetation here is an unusual mix of shrubland and low rainforest on saturated rocky ground. The canopy is just 1–3 m tall, and the ground layer is rich in pteridophytes.

A brief comment on the spelling of Hawaiian place names in the specimen citations is in order. The spellings adopted here are those given by Pukui et al. (1974), in which the macron (¯) is used to indicate long vowels and the hamza (´) to indicate glottal stops. Although non-Polynesian authors are often tempted to omit these diacritical marks, doing so is a grammatical gaffe comparable to omitting

the umlauts from German words or the tildes from Spanish ones.

## NEW SPECIES

During an excursion into the Blue Hole in June 1990, Steve Perlman collected a *Cyanea* with very unusual leaves. The lamina was less than three times as long as wide, cordate at base, and only half as long as the petiole. Nearly all species of *Cyanea* have leaves in which the lamina is several to many times longer than wide; attenuate, cuneate, obtuse, truncate, or rounded at base; and much longer than the petiole. The sole exception is the aptly named *C. asarifolia* H. St. John, which is endemic to eastern Kaua'i and also occurs in the Blue Hole. However, the unidentified *Cyanea* differed from *C. asarifolia* by having the lamina ovate or oblong (vs. cordiform), 3.7–5.8 (vs. 7–8) cm wide, twice as long as wide (vs. almost as wide as long), with scattered hairs along the midrib on the lower surface (vs. glabrous), the margin callose-serrulate (vs. minutely callose-crenulate), the base often markedly asymmetric (vs. symmetric); and by having the inflorescences 8–11-flowered (vs. 30–40-flowered), sparsely pubescent (vs. glabrous), the peduncle 4–4.5 (vs. 2.5–3) cm long, the pedicels 12–15 (vs. 7–10) mm long, and the bracts 5–7 (vs. 1.5) mm long.

Perlman was able to locate only a single large individual just beginning to flower plus three juveniles. Despite the lack of mature flowers and fruit, it is clear that these plants cannot be referred to any previously described member of the Lobelioideae and that they represent an undescribed species. We realize that publishing a novon on the basis of a single immature specimen is a less than commendable practice. However, extenuating circumstances dictate timely publication in this case. First, fertile material is not likely to become available anytime in the foreseeable future. A survey of the type locality in October 1992, six weeks after Hurricane



Iniki struck Kaua'i, revealed that all known individuals of this species had been destroyed by the hurricane. Although it is likely that additional plants survive on the cliffs surrounding the Blue Hole, the vertical aspect and great height of these cliffs renders them virtually impossible to explore. Second, because of its apparent rarity, this species merits protection under the Endangered Species Act of 1973. However, to be listed, it must first "exist," i.e., be described and have a name.

***Cyanea dolichopoda*** Lammers & Lorence, sp. nov. TYPE: Hawaii. Kaua'i: Blue Hole, N fork of Wailua River, S side of Blue Hole, *Metrosideros polymorpha* lowland wet shrubland with *Pipturus*, *Cyrtandra*, *Touchardia*, *Cyanea asarifolia*, *Lysimachia filifolia*, *Hedyotis elatior*, 1 June 1990, S. Perlman 11070 (holotype, PTBG). Figure 1.

A *Cyanea asarifolia* laminis ovatis, duplo longioribus quam latioribus, 3.7–5.8 cm latis, pubescentibus in pagina inferna secus costam, margine callososerrulato, basi saepe asymmetrica; et inflorescentiis 8–11-floris, pubescentibus, pedunculis 4–4.5 cm longis, pedicellis 12–15 mm longis, bracteis 5–7 mm longis differt.

Shrub, 1 m tall; stem unbranched, erect, unarmed, glabrous. Lamina ovate or oblong, 6.5–10 cm long, 3.7–5.8 cm wide; upper surface green, glabrous; lower surface light green, with scattered hairs along the midrib; margin callose-serrulate; apex acute or obtuse; base cordate, often markedly asymmetric; petiole 9–16 cm long, slender, glabrous. Inflorescence (not fully expanded) spreading or pendent, 8–11-flowered, sparsely pubescent; peduncle 4–4.5 cm long, slender; rachis 2–2.7 cm long; bracts linear, 5–7 mm long; pedicels 12–15 mm long, spreading, bibracteolate at the middle; bracteoles linear, 7.5–8 mm long. Corolla (in bud) pinkish, glabrous. Fully expanded flowers, fruits, and seeds not seen.

*Distribution, Habitat and Phenology.* *Cyanea dolichopoda* is known only from the relatively inaccessible type locality on Kaua'i, where it grew on a cliff face at ca. 700 m elevation (S. Perlman, pers. comm.). Judging from the size of the flower buds, anthesis might be expected to commence in middle to late June.

*Etymology.* The specific epithet was coined by combining the Greek words *dolichos*, long, and *podion*, foot, in reference to both the long peduncles and the long petioles.

*Relationships.* Both *Cyanea dolichopoda* and its close relative *C. asarifolia* are members of section *Delisseoideae* (Hillebrand) Rock. This group in-

cludes about a dozen species and is found on all of the main Hawaiian Islands but Hawai'i. The *Delisseoideae* are characterized by their shrubby habit, relatively slender unarmed stems, entire or minutely toothed petiolate leaves, typically glabrous flowers, hypanthium 2–6(–8) mm long, calyx lobes typically dentiform, 0.5–1 mm long, and corollas 15–30(–40) mm long, with lobes about as long as the tube. In the treatment of *Cyanea* in the *Manual*, *C. dolichopoda* would key with difficulty to *C. asarifolia*, from which it may be distinguished by the characters given above.

#### RESURRECTION OF *CYANEA REMYI* ROCK

In addition to *C. dolichopoda*, botanists exploring the Blue Hole collected a second unusual species of *Cyanea*. This plant was present in larger numbers, with a total of three healthy populations numbering approximately 200 individuals scattered in the understory at 600–730 m elevation (S. Perlman and K. Wood, pers. comm.).

Similar plants were encountered in south-central Kaua'i, some 9–10 km south of the Blue Hole, in the Wahiawa Mountains and the drainage of Wahiawa Stream, during a botanical inventory of that region. The rugged mountainous terrain of this bowl-shaped region is dissected by numerous stream systems and covered by lowland rainforest and boggy shrubland. Six populations of the unidentified plant, numbering 110 juveniles and adults in all, were encountered here at elevations of 660–780 m in forest understory (Lorence & Flynn, 1991).

Most recently, this same unidentified species was encountered in northern Kaua'i at the headwaters of Wai'oli Stream. Here, two sterile plants were discovered in the understory of lowland rainforest at 370 m elevation (S. Perlman and K. Wood, pers. comm.). This third site is located approximately 11 km north of the Blue Hole and 20 km north of the Wahiawa Mountains.

The plants from these three localities could not be referred to any species of *Cyanea* described in the *Manual* and were thought by their collectors to represent a species new to science. However, when specimens were shown to the senior author in 1989, he suggested that they might represent *C. remyi*, which had not been included in the *Manual*. This species had been described by Rock (1919) on the basis of a single specimen deposited at Paris, which had been collected on "Kauai ou Nihau" (i.e., Kaua'i or Ni'ihau) sometime during the early 1850s by Jules Rémy. This specimen, which the senior author had examined at Paris in 1987, consisted of a single stem bearing a few large leaves, two inflorescences



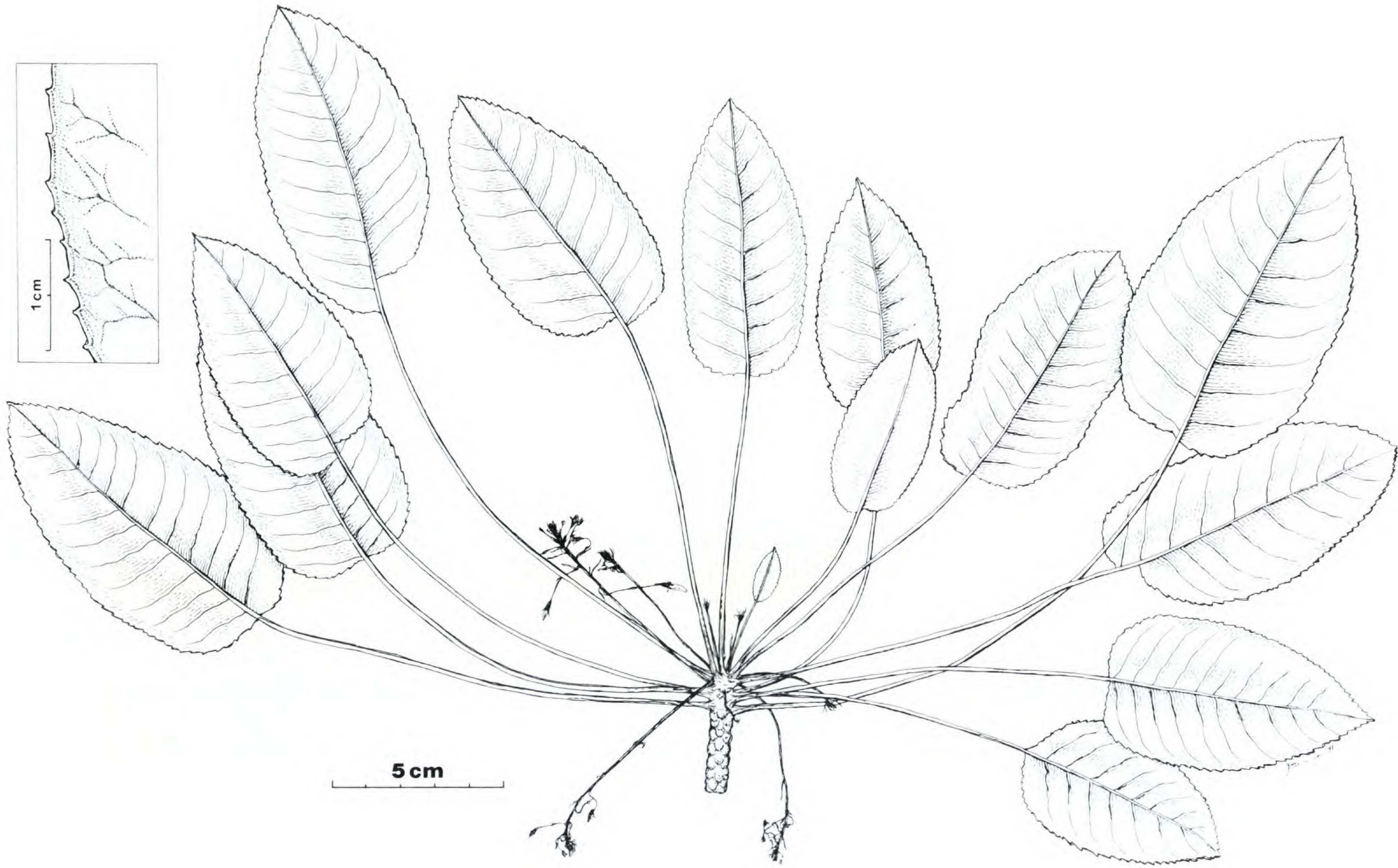


Figure 1. *Cyanea dolichopoda* Lammers & Lorence, apex of plant; inset shows portion of leaf margin, enlarged (from the holotype).



with immature flower buds, plus a detached inflorescence apex (cf. Rock, 1917: pl. 12; 1919: pl. 158).

In the 130 years following Rémy's visit, *C. remyi* was collected just once more. In 1916, C. N. Forbes gathered sterile specimens of an unknown *Cyanea* in the Hi'i (Wahiawa) Mountains of Kaua'i. It was subsequently identified as *C. remyi* by Wimmer (1943).

In preparing the treatment for the *Manual*, the senior author of the present paper came to essentially the same conclusion regarding *C. remyi* as Wimmer (1943: 78), who commented "Species non satis nota et eius positio dubia." With only the incomplete holotype and Forbes's sterile gathering at hand, it was not possible to characterize the species adequately and to include it in the dichotomous key. Instead, *C. remyi* was merely mentioned in the discussion under *C. truncata* (Rock) Rock, a species with leaves that are somewhat similar in size and shape.

In order to determine whether the unidentified plants were referable to *C. remyi*, the holotype was borrowed and examined by both authors in 1991. After a thorough comparison, there was no doubt that the recent collections from all three localities on Kaua'i, as well as Forbes's 1916 collection, were in fact all referable to that species. The holotype and Forbes's specimen fell well within the range of variation seen within and among the three extant populations. As a result, *C. remyi* is here resurrected and described more fully on the basis of the flowering and fruiting material now available.

***Cyanea remyi*** Rock, Bull. Torrey Bot. Club 44: 233. 1917. *Delissea remyi* (Rock) H. St. John, Phytologia 63: 87. 1987. TYPE: Hawaiian Islands, "Kauai ou Nihau," 1851-55, *J. Rémy 302bis* (holotype, P). Figure 2.

Shrub, 0.9-2 m tall; stem unbranched (occasionally with 1 or 2 branches from base), 1-2.5 cm diam., erect, unarmed, dark purple and pubescent toward apex, brown and glabrous below; latex light yellow (occasionally white), thin. Lamina broadly elliptic, ovate, or broadly oblong, 16-40 cm long, 9.5-19.5 cm wide; upper surface green, glossy, glabrous, the midrib maroon or dark purple at least in the lower 1/3; lower surface whitish green, glossy, with scattered short white hairs on the midrib and veins; margin minutely callose-denticulate; apex obtuse, acute, acuminate, or cuspidate; base subcordate, truncate, rounded, or obtuse; petiole 8-20 cm long, 2-5 mm diam., maroon or dark purple, glabrous or pubescent with short white hairs. Inflores-

cence ascending, 6-13-flowered, pubescent with short white hairs; peduncle 4-8 cm long, 2-4 mm diam., maroon or dark purple; rachis 0.5-2 cm long, maroon or dark purple; bracts linear, 3 mm long, 0.6 mm wide, deciduous; pedicels 10-21 mm long, bibracteolate at or below the middle, maroon or dark purple; bracteoles linear, 1-3 mm long. Hypanthium obovoid or obconic, 9-12 mm long, 5-9 mm diam., dark purple, pubescent with short white hairs. Calyx lobes triangular or narrowly triangular, spreading or ascending, 4-6 mm long, 1-2 mm wide, dark maroon; apex acute. Corolla bilabiate, 40-53 mm long, dark purple, shading to purplish white at the apex of the lobes on their inner surface, densely pubescent with short white hairs; tube curved, 30-31 mm long, 5-5.5 mm diam., cleft dorsally for ca. 1/2 its length; dorsal lobes linear, spreading and slightly recurved, 19-22 mm long, 2-2.5 mm wide, acute at apex; ventral lobes linear, spreading and slightly recurved, 15-20 mm long, 2-2.5 mm wide, acute at apex. Staminal column slightly exerted; filaments 32-40 mm long, purplish white, glabrous; anther tube 10-11 mm long, 2 mm diam., purplish white, the lower 2 anthers with tufts of white hairs at apex, otherwise glabrous. Berry spherical, 10-13 mm long, 10-13 mm diam., maroon or dark purple with orange flesh, tuberculate. Seeds minute, black or dark brown, smooth, shining. Chromosome number (M. Kiehn, pers. comm.)  $2n = 28$ .

*Distribution, Habitat and Phenology.* Extant populations are known from three localities on Kaua'i, in the upper reaches of the Wailua River, Wahiawa Stream, and Wai'oli Stream. The plants occur on wet seeping or saturated rocky substrates in areas of rainforest and shrubland at 370-770 m. Flowering specimens were collected in June, July, and September, and fruiting ones in September, November, and April.

Although the holotype is labeled "Kauai ou Nihau," *C. remyi* is here considered to be endemic to the former. Certainly, the extreme wetness of the known localities, as well as their elevational range, suggests that the holotype could not have been collected on the much drier island of Ni'ihau, which is just 390 m above sea level at its highest point.

*Etymology.* This species commemorates French naturalist and traveler Ezechiel Jules Rémy (1826-1893), who collected several hundred botanical specimens in the Hawaiian Islands during the early 1850s.

*Additional specimens examined.* HAWAII. **Kaua'i:** Hanalei District, Wai'oli Stream, back of valley, *Wood & Perlman 1494* (PTBG); boundary of Lihu'e and Ka-



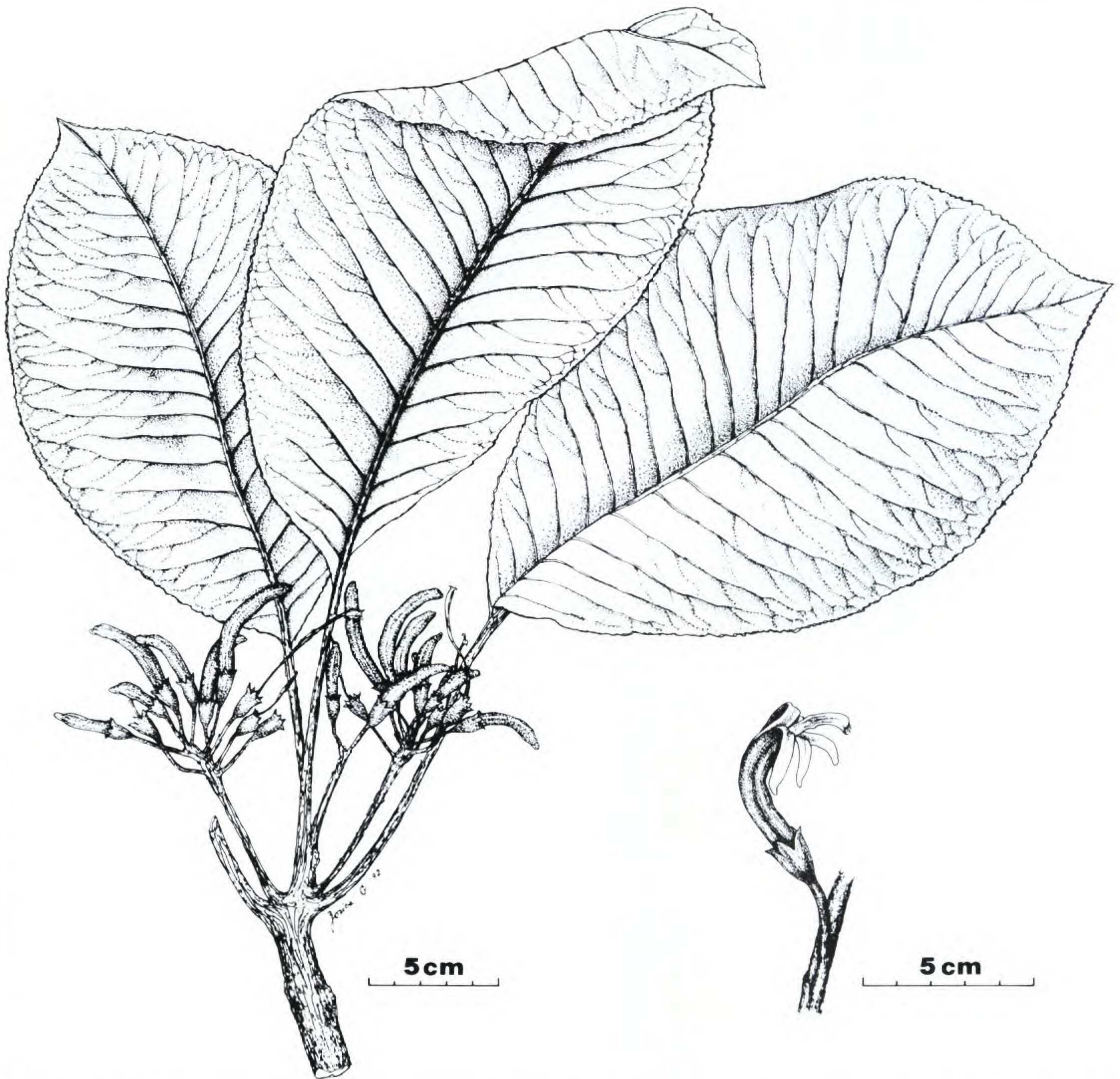


Figure 2. *Cyanea remyi* Rock, apex of plant (based on Wood *et al.* 0098); inset shows single flower, enlarged slightly (based on Lorence *et al.* 6592 and on a color transparency by D. H. Lorence).

waihau districts, headwaters of N fork of Wailua River, area called "The Blue Hole" or "The Crater," Lorence *et al.* 5327 (F, PTBG), Wood *et al.* 0098 (F, PTBG), Wood *et al.* 0352 (PTBG), Lorence *et al.* 6561 (F, PTBG), Lorence *et al.* 6565 (F, PTBG), Flynn *et al.* 3990 (PTBG), Lorence *et al.* 6592 (PTBG), [voucher for chromosome count] Kiehn 900823-1/5 (WU not seen), Wood *et al.* 1125 (PTBG), Wood *et al.* 1114 (PTBG), Wood & Perlman 1353 (PTBG); Hi'i Mts., Forbes 660.K (B, BISH); Līhu'e-Kōloa F. R., Wahiawa Mts., just NE of Wahiawa Bog, along N fork of Wahiawa Stream, NW of Mt. Kāhili, Lorence *et al.* 5949 (BISH, PTBG), Wagner *et al.* 6061 (BISH not seen), Wood *et al.* 0544 (PTBG); Līhu'e-Kōloa F. R., Wahiawa Mts., W ridge, below rope trail, Wood *et al.* 1206 (PTBG); Līhu'e-Kōloa F. R., Wahiawa Mts., NW of Wahiawa Bog, along tributary of Wahiawa Stream, NW of stream and SE of Hulua, Flynn & Wood 3237 (PTBG), Flynn & Wood

3238 (PTBG); Līhu'e-Kōloa F. R., Wahiawa drainage, Flynn *et al.* 4493 (PTBG); Līhu'e-Kōloa F. R., W side of Wahiawa drainage, below ridge between Hulua and Pu'uau'uka, Wood *et al.* 1365 (PTBG).

*Relationships.* *Cyanea remyi* is referable to section *Hirtellae* Rock, a group of eight species endemic to Kaua'i, which is characterized by shrubby habit, relatively slender unarmed stems, entire or minutely toothed petiolate leaves, densely pubescent flowers, hypanthium 6–11 mm long, calyx lobes triangular, 1–5(–16) mm long, and corollas 25–53 mm long, with lobes about as long as the tube. *Cyanea remyi* may be incorporated into Lammers's (1992) key to the species of *Hirtellae* by appending the following couplet to the beginning of that key:



- 0a. Lamina ovate, broadly elliptic, or broadly oblong, the base subcordate, truncate, rounded, or obtuse; petiole 8–20 cm long ..... *C. remyi*  
 0b. Lamina narrowly elliptic, obovate, oblanceolate, or oblong, the base attenuate or cuneate (rarely obtuse); petiole 0.5–9 cm long .....  
 ..... (remainder of *Hirtellae*).

In the *Manual*, *C. remyi* would key with some difficulty to *C. sylvestris* A. Heller, another member of the *Hirtellae*. The two species are similar in their relatively wide leaves (typically more than 6 cm wide), ascending peduncles, and large flowers (corolla more than 4 cm long). However, *C. remyi* differs from *C. sylvestris* in its shorter stature (0.9–2 m vs. 1.5–6 m tall) and in having the lamina ovate, broadly elliptic, or broadly oblong (vs. obovate or oblanceolate) and subcordate, truncate, rounded, or obtuse (vs. cuneate) at base; petioles 8–20 (vs. 2.5–8) cm long; peduncles 4–6.5 (vs. 1–4) cm long; corolla dark purple (vs. white with longitudinal purple stripes); and berries spherical (vs. obovoid), 10–13 (vs. 7–10) mm in diameter, maroon or dark purple (vs. orange or yellow).

*Cyanea truncata*, the species under which *C. remyi* was previously discussed (Lammers, 1990), is a member of section *Cyanea*. It differs from *C. remyi* by having its stems and petioles muricate; lamina obovate, with a cuneate or truncate base; inflorescences horizontal or pendent; bracts narrowly oblong, 9–20 mm long; hypanthium 5–6 mm long; calyx lobes narrowly oblong, obtuse at apex; corolla 32–42 mm long, the lobes only  $\frac{1}{4}$ – $\frac{1}{2}$  as long as the tube; and berries orange, 8–10 mm long, 8–10 mm in diameter. Additionally, it is known only from O'ahu.

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